## *Research Note*

# Comparing International Crash Statistics

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## ABSTRACT

In order to examine national developments in traffic safety, crash statistics from several of the more developed countries are compared with those of the United States. Data obtained from the Fatality Analysis Reporting System (FARS) and the International Road Traffic and Accident Database (IRTAD) are analyzed. Trend analysis results for the countries included, the United States, the European Community, Canada, Japan, New Zealand, and Australia, show that all regions have experienced decreases over time in the fatality rate per 100,000 population as well as the fatality rate per 100,000 registered vehicles. Fatality data are partitioned by age group, travel type, and roadway type. A variety of problems in collecting and analyzing international data is presented with some recommendations for further improvement.

## INTRODUCTION

Traffic crashes and their attendant injuries and fatalities are a worldwide public health problem. To address national developments in the area of traffic safety more accurately, it is advantageous to view traffic crashes in an international context. As such, the German Federal Ministries of Transport, Building and Housing, and the Federal Highway Research Institute (BASt) established an International Road Traffic and Accident Database (IRTAD) in the mid-1980s. Since 1990, that database has been operated within the framework of the Road Transport Research Programme within the Organization for Economic Co-operation and Development (OECD) in Paris, France and includes aggregate data from all OECD countries, with BASt acting as the administrator of the database. The purpose of this database is to provide international comparative traffic safety statistics for its members. IRTAD is the only international database that attempts to provide historical consistency and international comparability for traffic crash data. However, IRTAD does not address risk in terms of different vehicle types or roadways.

This paper examines the safety statistics of some of the more developed nations around the world that participate in this database. The regions included in this paper are the Unites States, the European Community (Austria, Belgium, Denmark, Finland, Germany, Greece, France, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom), Canada, Japan, and the Pacific Region (New Zealand and Australia).

The data used in this report came from the annual reports on traffic crashes, injuries, and fatalities issued by the respective countries and submitted, in a uniform format, to the IRTAD from 1980 to 1996. The U.S. fatality data came from the Fatality Analysis Reporting System (FARS). Meeting the exacting requirements of IRTAD, the U.S. injury crash data are the sums of counts of police-reported injury crashes collected by the individual states and submitted to the Federal Highway Administration, rather than the National Highway Traffic Safety Administration (NHTSA) General Estimates System (GES) estimates derived from a sample of

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approximately 50,000 crashes. This uniform data collection and reporting procedure is followed by each participating nation and provides the most comparable data for international analysis.

IRTAD provides the following data for all of the nations included in this paper:

1. Number of injury accidents classified by road types,
2. Fatality figures with a breakdown by vehicle type, age groups, and road type,
3. Population data, and
4. Vehicle registration data.

Two measures of traffic safety were used: the number of fatalities and the number of injury crashes by year. Data for these two variables were generally available for the countries included in this paper. The exception was the number of injury crashes for Australia, which was not available.

## FATALITIES

A traffic crash-related fatality is defined by the Vienna Convention as an individual who dies at the scene of the crash or within 30 days following the crash (Pozuelo and Izarzugaza 1996). This definition is consistent with the definition used by NHTSA, with the imposition of a further restriction, that the traffic crash must occur on a roadway customarily open to the public. Although there is an international standard definition, it is not used by all OECD countries. Not all countries follow the 30-day time frame. To address the problem of comparing fatalities across international lines, the fatality data were adjusted by IRTAD to approximate the international definition. IRTAD applied the following internationally-agreed on adjustment factors to the fatality data submitted by each nation. The number in parentheses indicates each country's standard time frame for a fatality's inclusion in a crash report.

- Austria: (3 days) 1980 to 1982 +15%, 1983 to 1991 +12%
- France: (6 days) 1980 to 1992 +9%, since 1993 +5.7%
- Greece: (3 days) before 1996 +15%
- Italy: (7 days) +8%
- Japan: (24 hours) before 1993 +30%
- Portugal: (less than 24 hours) +30%
- Spain: (24 hours) before 1993 +30%

Lack of a single international definition of a traffic fatality used by all of the OECD countries is perhaps the most serious problem in the analysis of international fatality crash data. Additionally, in virtually all OECD countries, some traffic deaths are missed and not included in the national statistics. Matthijs J. Koornstra, President of the IRTAD Management Bureau of the Steering Committee for the Road Transport Research Programme of the OECD, pointed out in the forward of A. Mónica Colás Pozuelo and J. Izarzugaza's report (1996) that: "The nonregistered road fatalities and inaccurateness in the reporting of road fatalities is a problem in every country, even if this is officially denied." Hence, the fatality data within this paper must be considered best estimates with associated errors rather than actual counts.

Trends for fatalities and injury crashes are presented for 1980 to 1996. Fatality data for Greece and Luxembourg were not available for 1996; 1995 data were used as proxies. Injury crashes include fatal crashes. Tables 1 and 2 show the numbers of fatalities and injuries for each geographical area by year Figure 1 shows the yearly fatality trends for each geographical area. Figure 2 shows the percentage change in fatalities measured from 1980. The European Community and the United States dominate other geographical areas in numbers of fatalities. Although the European Community had 13,000 more fatalities than did the United States in 1980, its lead had decreased to less than 2,000 by 1996. Canada has experienced the largest percentage decrease in fatalities, over 40%, from 1980 to 1996. Japan is the only area where the fatalities have increased over time.

## CRASHES

Henrik Hvoslef (1994) points out that there is a serious problem of under-reporting traffic crashes. Susanne Berns (1998, 20) states that

> The registration of injured accident victims constitutes a large problem. The under-reporting of traffic accidents depends very much on the type of accident. In general, serious injuries are more often reported to the police than slight injuries. The level of under-reporting depends on a number of factors. It can also vary from one country to another due to national factors: how accidents are defined, how serious the least reportable injury is, etc. Differences in the local

**TABLE 1 Number of Fatalities by Year**

| Year | U.S. | E.C. | Canada | Japan | Pacific |
|---|---|---|---|---|---|
| 1980 | 51,091 | 64,199 | 5,461 | 11,388 | 3,871 |
| 1981 | 49,301 | 61,530 | 5,383 | 11,335 | 3,989 |
| 1982 | 43,945 | 60,135 | 4,169 | 11,795 | 3,926 |
| 1983 | 42,589 | 59,698 | 4,216 | 12,376 | 3,399 |
| 1984 | 44,257 | 56,817 | 4,120 | 12,041 | 3,491 |
| 1985 | 43,825 | 52,644 | 4,364 | 12,039 | 3,687 |
| 1986 | 46,056 | 54,736 | 4,068 | 12,112 | 3,654 |
| 1987 | 46,390 | 52,705 | 4,286 | 12,151 | 3,571 |
| 1988 | 47,087 | 55,046 | 4,154 | 13,447 | 3,615 |
| 1989 | 45,582 | 55,972 | 4,246 | 14,412 | 3,563 |
| 1990 | 44,529 | 56,374 | 3,960 | 14,595 | 3,060 |
| 1991 | 41,462 | 55,960 | 3,691 | 14,436 | 2,763 |
| 1992 | 39,235 | 52,729 | 3,501 | 14,886 | 2,627 |
| 1993 | 40,150 | 48,211 | 3,615 | 13,269 | 2,553 |
| 1994 | 40,716 | 46,479 | 3,263 | 12,768 | 2,517 |
| 1995 | 41,798 | 46,047 | 3,347 | 12,670 | 2,598 |
| 1996 | 41,907 | 43,828 | 3,082 | 11,674 | 2,487 |

**TABLE 2 Number of Reported Injury Crashes**

| Year | U.S. | E.C. | Canada | Japan | N.Z. |
|---|---|---|---|---|---|
| 1980 | 2,074,257 | 1,400,085 | 184,302 | 476,677 | 10,728 |
| 1981 | 2,062,285 | 1,367,989 | 183,643 | 485,578 | 10,659 |
| 1982 | 2,007,687 | 1,356,587 | 160,376 | 502,261 | 11,256 |
| 1983 | 2,043,414 | 1,352,762 | 160,623 | 526,362 | 11,511 |
| 1984 | 2,176,716 | 1,333,123 | 168,801 | 518,642 | 12,561 |
| 1985 | 2,257,695 | 1,277,991 | 183,478 | 552,788 | 13,548 |
| 1986 | 2,294,762 | 1,296,881 | 187,563 | 579,190 | 13,465 |
| 1987 | 2,335,438 | 1,274,772 | 196,966 | 590,723 | 13,362 |
| 1988 | 2,344,629 | 1,331,515 | 193,704 | 614,481 | 12,561 |
| 1989 | 2,425,077 | 1,348,675 | 196,246 | 661,363 | 12,004 |
| 1990 | 2,540,946 | 1,342,844 | 181,960 | 643,097 | 12,818 |
| 1991 | 2,227,053 | 1,301,398 | 173,921 | 662,388 | 12,163 |
| 1992 | 2,251,173 | 1,291,028 | 172,713 | 695,345 | 11,639 |
| 1993 | 2,216,092 | 1,236,472 | 171,205 | 724,675 | 10,994 |
| 1994 | 2,128,223 | 1,258,191 | 169,622 | 729,457 | 11,876 |
| 1995 | 2,371,844 | 1,268,847 | 167,038 | 761,789 | 12,220 |
| 1996 | 2,448,145 | 1,250,963 | 167,038 | 771,084 | 10,564 |

tradition for reporting accidents to the police and how the recording procedure is organized are other important factors explaining differences between countries.

At the personal level, there are also several reasons for the under-reporting of crashes. Ignorance of the legal obligation, forgetting, that the injury only becomes obvious after the crash, and fear of prosecution for being engaged in unlawful or criminal activities are among the reasons given. Injury crash reporting also varies with the inclusion of crash victims treated on a hospital out-patient basis only and/or pedalcyclists injured in the crash.

The rate of reporting crashes also varies over time. Norway, though not a member of the European Community and therefore not included in this paper, provides an excellent example of how increased public awareness combined with improved reporting routines by the police resulted in an increase in reported injury crashes. The rate at which crashes are reported can also vary within a

**FIGURE 1 Fatalities by Year**

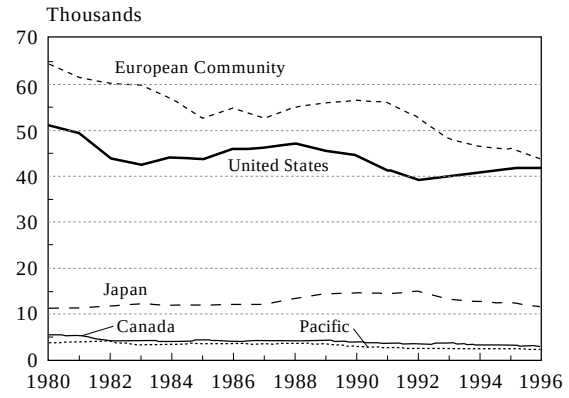
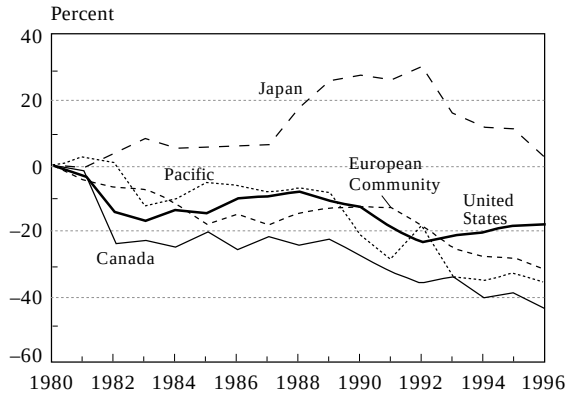



**FIGURE 2 Percentage of Change in Fatalities from 1980**




country or a district and between rural and urban areas. Also, the rate is often a function of the distance to the nearest hospital or emergency facility. Koornstra goes so far as to state "One at least ought to question the validity of any international comparisons on general road safety, if it is not based on fatalities only"(qtd. in Hvoslef 1994, forward). Hvoslef (1994, 4) further reports:

> It is commonly known that not all traffic accidents with personal injury are reported to the police, even if they are supposed to be so by law. Research done in several countries by matching data from hospitals with police records, both of in-patients and out-patients, reveals that the police are receiving information on about 30–60% of all the personal injury accidents they are supposed to know about.

Not only is there a problem of under-reporting, there is also a problem of under-recording. Again, Hvoslef states (1994, 5–6)

> Another problem is under-recording, a problem connected to the way the recording by police is organized, procedures for filling out forms, etc. Some casualties recorded in paper reports do not appear in the computer files, most likely due to clerical errors. In some cases, casualties treated in hospitals occurred in accidents recorded by the police as "damage-only" accidents. In many cases, this is connected to injuries being reported to the police some days after the accident, often the case for whiplash injuries. A third reason for under-recording occurs when there is a lack of detailed information about the injured person. A study in Greater Manchester (Hopkin et al. 1993) revealed that under-recording occurred in 12% of the cases treated in hospitals when an injury was diagnosed and in 20% of the casualties where information about the accident was reported to the police.

With all of the caveats listed above, table 2 and figures 3 and 4 provide the number of reported injury crashes by year, 1980–1996. Due to the problems with injury crashes identified above, the data for injury crashes are limited to these three

**FIGURE 3 Injury Crashes by Year**

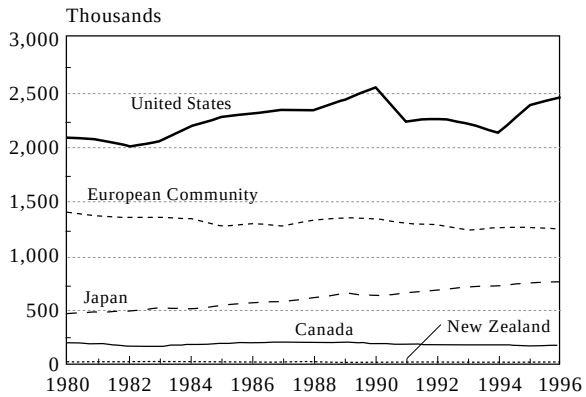
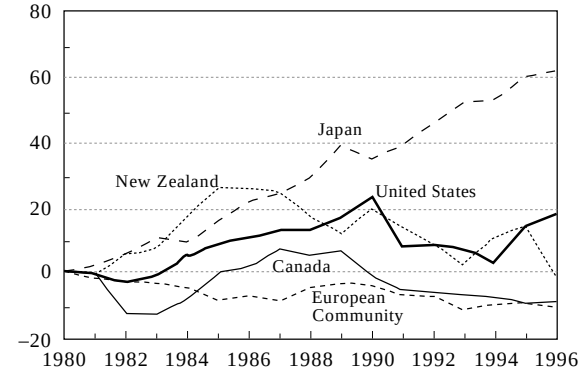



**FIGURE 4 Percentage of Change in Injury Crashes from 1980**



examples. Australia does not report the number of injury crashes; therefore, data are reported only for New Zealand. As noted above, the procedures for reporting injury-related crashes in the countries under study vary considerably. In table 1, we see that the number of U.S. fatalities is always less than the number of fatalities in the European Community. However, the United States reports almost twice the number of injury crashes as does the European Community.

With the large differences in reporting standards, it is inappropriate to compare total reported crashes across regions. However, we can examine the change in reported injury crashes within each geographical area. The United States, the European Community, Canada, and New Zealand are within 20% of the levels reported in 1980. The number of reported injury crashes in the United States increased approximately 18%. The European Community, Canada, and New Zealand reported decreases in injury crashes of 11%, 9%, and 2%, respectively. Japan reported that injury crashes rose 62% (see figure 4). The number of injury crashes was not available for Greece, Luxembourg, or Canada for 1996. The 1995 data were used in their place.

## FATALITY RATES

Although most of the crash fatalities are reported and accepted correction factors are applied, comparisons of the absolute number of fatalities across geographical areas are not very useful. The various geographical areas have different populations, mixes of road structures, traffic compositions, and usage patterns. A better approach is to compare fatality rates adjusted for some amount of relevant exposure. The need for these exposure measures is clear. However, there are no internationally agreed on standards.

The number of vehicle-miles traveled is one of the most popular measures of exposure within the United States. The corresponding international measure of exposure, number of vehicle-kilometers traveled, is collected and reported to BASt by many of the countries within the European Community but not by all. Therefore, any attempt to report the European Community's data in this manner would be so highly flawed that all such references have intentionally been omitted.

**FIGURE 5 Fatality Rates**

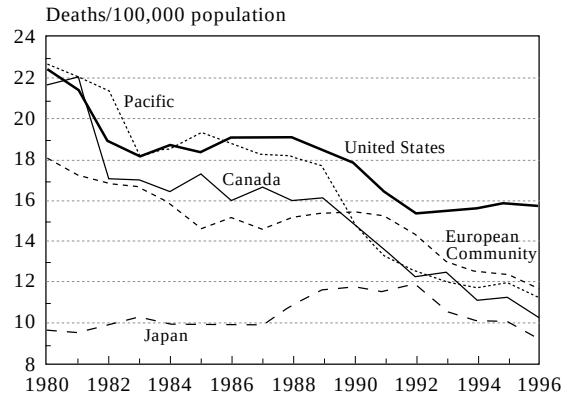
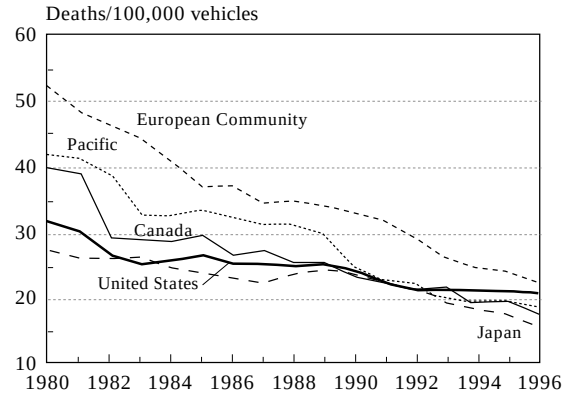



Figure 5 reports fatality rates per 100,000 population. In 1980, Canada had the highest rate of fatalities per 100,000 residents (22.71 fatalities per 100,000 residents). Canada also experienced the greatest reduction in the fatality rate per 100,000 residents between 1980 and 1996, when it had the second lowest rate of any geographical area: 10.29 fatalities per 100,000 residents in 1996. Japan reported the smallest decline in fatalities per 100,000 residents between 1980 and 1996, 5%. However, for all years of the study, Japan had the lowest fatality rates.

Figure 6 reports the fatality rates per 100,000 registered vehicles. Since 1980, all geographical areas have experienced substantial drops in the rate of fatalities per 100,000 registered vehicles. The rates have dropped by approximately 35% for the United States, 40% for Japan, and 55% for the European Community, Canada, and the Pacific Region.

**FIGURE 6 Fatality Rates per Vehicle**



A serious mistake can be made in interpreting these data, namely, to assume a direct cause and effect relationship between the increase in the population or number of registered vehicles and the decrease in fatality rate, adjusted by population or by the number of registered vehicles. (This same phenomenon is noticed with vehicle-kilometers traveled in the denominator). Although at first glance it appears that this relationship may exist, the actual situation is more complex. There are several other "lurking" variables that contribute to the reduction in rates.

The observed reduction in rates spans several years. The time period of interest for this paper is 1980 to 1996. Over this period, several factors have contributed to the rate reduction. A short list of these factors includes: increased use of seat belts, reductions in drinking and driving, installation of daytime running lamps, introduction of anti-lock brakes, use of center high mounted stop lamps, airbags, safety education programs, stricter alcohol/driving laws, improvements in roadway construction, improvements in emergency medical service, and improved medical care. The available data do not have the fidelity to estimate the effects of these variables, but they exist nonetheless. The point is that the reduction in the fatality rate is due to the effects of these and similar variables, not the increase in population or number of registered vehicles.

Nilsson (1997, 17) points out that "comparisons of fatality rates and injury rates must be done for homogeneous environments and road user groups, not for whole countries and all road user groups." Figures 7 to 10 attempt to address this concern. The distributions of fatalities by age group are similar for the United States, the European Community, and Canada. The Japanese have a larger portion of their fatalities in the 65 and older category, over 30%. The Pacific Region has almost 30% of their fatalities in the 15–24 year old category, higher than any other region (see figure 7). There were no 1996 data available for Greece, Canada, or Italy; data from 1995 were used for both Greece and Canada; data from 1994 were used for Italy.

Figure 8 presents information on the fatality rates by age group for the geographic areas. The United States and the European Community have similar patterns. However, the European Community's fatality rates are slightly lower than those of the United States for all age groups. Japan's fatality rates are the lowest for all age groups, with the exception of 65 and older age group. Only the United States' fatality rate for the 65 and older age group exceeds Japan's fatality rate for the same group.

**FIGURE 7 Percentage of Fatalities by Age Group**

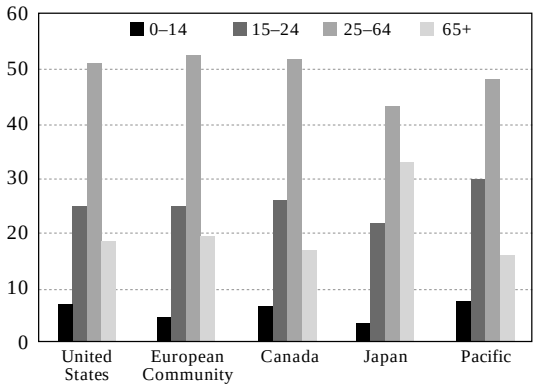
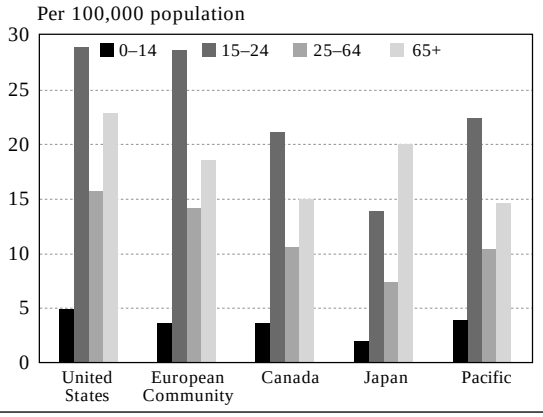



**FIGURE 8 Fatalities by Age Group**




Fatalities can be classified into four categories of travel type: pedestrians; bicyclists; riders of motorized two-wheel vehicles, including motorcycles and motor scooters; and occupants of passenger cars and station wagons. Light trucks, sport utility vehicles, and vans are not addressed in these data. Figure 9 shows that the United States, the European Community, Canada, and the Pacific Region have somewhat similar distributions of fatalities by travel type. Japan has a larger proportion of pedestrian and bicycle fatalities and correspondingly fewer passenger car fatalities. Canadian data for

**FIGURE 9 Percentage of Fatalities by Travel Type**

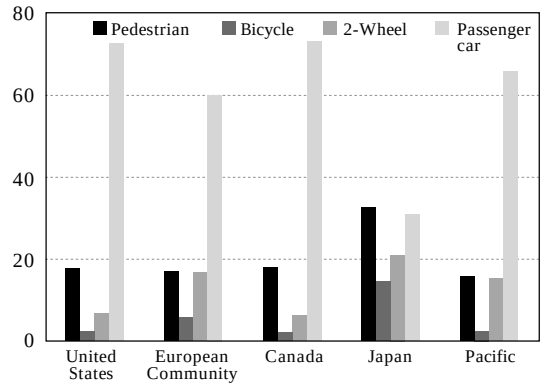
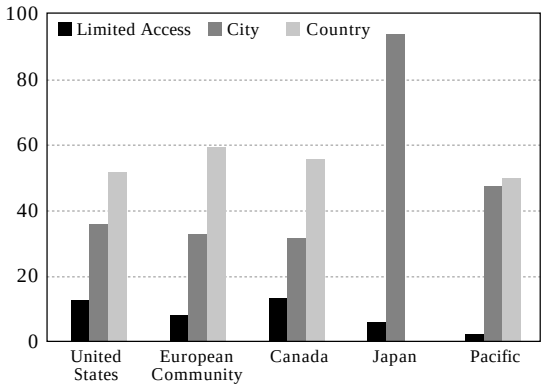



**FIGURE 10 Percentage of Fatalities by Roadway Type**




motorized two-wheel vehicles and passenger cars in 1996 were missing; 1995 data were used in their place. The 1996 data from Greece and Italy were also missing. Similar data from 1995 and 1994, respectively, were used as surrogate data. Data were not available from Australia for riders of motorized two-wheel vehicles and passenger cars. The data were estimated using the total fatalities for Australia and the proportions from New Zealand.

Roadway type has been divided into three categories: limited access, city, and country. Limited access roads include both urban and rural limited access roads. City roads consist of all public, urban, nonlimited access roads. Country roads are public, rural, nonlimited access roads. Japan does not provide information on country road fatalities. The United States, the European Community, and Canada have similar patterns of fatalities for roadway type (see figure 10). The Pacific countries have almost equal numbers of fatalities on both city and country roads. Data for 1996 were not available for Italy, Canada, or Australia. Data from 1995 were used for Italy and Canada, and 1992 data were used for Australia. The limited access data for Denmark were from 1995, while the country data came from 1994. Both the city and country data for Luxembourg were from 1994. Data for limited access and country roads were not available for Greece and have been set to zero. This slightly underestimates the fatalities for limited access and country roads for the European Community.

## OBSERVATIONS

This paper has presented traffic crash data for some of the more developed nations around the world. Although progress has been made in improving the comparability of international safety data, much more work remains. There remain many differences in the data reported by various countries. A variety of jurisdictions, some local, others regional or national, have been involved in the collection and aggregation of the data. Each jurisdiction has applied its own set of criteria for data collection and dissemination. Although briefly mentioned within this report, ways to resolve these differences have not been thoroughly addressed and are beyond the scope of this note.

Nonetheless, areas for further improvement include:

- Standardizing definitions of crash data and the associated data collection methods and reporting thresholds so that data can be compared across international boundaries;
- Until standard collection and reporting methods have been adopted, developing a set of adjustment factors for each country to account more accurately for the number of traffic crashes at all levels;
- Creating an annual forum for the exchange of analysis techniques;
- Investigating procedures to link hospital data to crash data and implementing them where appropriate;

- Developing a uniform, verified, hierarchical database that documents crashes at the crash, vehicle/driver, and person levels. It may be possible to collect detailed data for all fatal crashes and a representative sample of injury crashes.

On the positive side, there is universal good news in the international statistics, in that every geographical region made progress in reducing fatalities over the past decade.

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